# SCIENCE

[Entered at the Post-Office of New York, N.Y., as Second-Class Matter.]

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

EIGHTH YEAR.
VOL. XVI. No. 408.

NEW YORK, NOVEMBER 28, 1890.

SINGLE COPIES, TEN CENTS.
$3.50 PER YEAR, IN ADVANCE.

## THE INTERMARRIAGE OF THE DEAF, AND THEIR EDUCATION.

AN intimate acquaintance with deaf-mutes for more than fifty years, and active labors among them as a teacher for nearly thirty-five years, may, perhaps, justify me in asking to be allowed to take part in the discussion concerning the deaf to which *Science* has recently opened its columns; and the two points on which I have a word to say are (1) the intermarriage of the deaf, and (2) their education.

I think that in considering the first point an important fact has been overlooked; namely, that with a large proportion of the persons commonly spoken of as "deaf-mutes" there is no more likelihood of giving the legacy of deafness to offspring than with perfectly normal people. Professor Bell, who stands as the most pronounced opponent of deaf-mute intermarriages, makes this clear in his testimony before the Royal Commission (*Minutes of Evidence*, p. 817). "No one," he says, "desires to bring misfortune on his offspring, and, if the deaf were so classified as to distinguish those who would be likely to transmit their defect from those who would not, many of the more intelligent of our pupils might avoid forming unions that would increase the chances of their having deaf children." Dr. Bell then gives in a footnote the following classification:—

**Classification of the Deaf into Four Groups as a Guide to Marriage.**

| Period of Life when the Deafness occurred. | Character of the Deafness. | |
|---|---|---|
| | Sporadic deafness. | Family deafness. |
| Before birth (congenital). | 2 | 4 |
| After birth (non-congenital). | 1 | 3 |

And he says, very truly, that "persons belonging to Class 1 do not manifest a tendency to transmit the defect to their children." This class consists of those who, born normal infants, and having no deaf-mute relatives, are made deaf by some one of the many diseases which affect the auditory organs, or become deaf through accident. It is not easy to determine absolutely the proportion this class bears to the whole number of deaf-mutes, but it is undoubtedly over fifty per cent; for our statistics show that sixty per cent of the whole number of deaf-mutes are known to have lost hearing from disease or accident, and there is a strong presumption that many reported as born deaf became so after birth at so early an age as to lead parents to suppose erroneously that they were born deaf. Making due allowance, then, for the cases believed to be comparatively few in number, classified by Dr. Bell under "Family Deafness after Birth," which could not be regarded as normal, it is safe to say that fully one-half of the deaf and dumb (to use a term now regarded as old-fashioned by many), have, according to Dr. Bell himself, no tendency to transmit their defect to their children. Among this half, therefore, intermarriages may occur without fear that deaf offspring will appear in any greater proportion than in the community at large; and those who oppose the marriage of the deaf among themselves should give due consideration to this very important fact. On the other hand, those who favor the unrestricted intermarriage of the deaf, most prominent among whom is your latest contributor in this discussion, Dr. Gillett of Illinois, should, I think, give more weight than they seem disposed to do to the acknowledged facts that marriages between two persons belonging to Dr. Bell's Class 4 are likely to result in a very large proportion of deaf children; that in marriages between persons belonging to Classes 2, 3, and 4 this tendency is decided; and that even in a marriage of persons belonging to Classes 1 and 2 this tendency is greater than among the general population. With many of Dr. Gillett's views, recently expressed in *Science*, I agree, and I honor him as one who has given a life of effective and unselfish labor to the cause of the deaf; but I think he errs radically in characterizing total deafness as "only a serious inconvenience;" and I am sure few hard-of-hearing persons even, much less those absolutely without hearing, will allow him to classify their infirmity with baldness or near-sightedness.

Deafness is certainly a grave misfortune, and those in whose person or in whose family it inheres are bound by altruistic considerations to take care that by no selfish act or course of theirs the aggregate of this misfortune in the world shall be increased. The deaf-mutes resident in the vicinity of Boston have lately discussed the subject of marriage, and have protested publicly against the attitude taken by Dr. Bell. They have disputed his claim that among the offspring of such marriages a large proportion of deaf children will be found; and one of their number, Mr. E. W. Frisbee,—an intelligent and worthy young man,—has taken pains to gather and publish statistics which he thinks sustain the views held by the Boston deaf-mutes. But unfortunately Mr. Frisbee is "hoist with his own petard:" for he says (in the *Deaf-Mute's Journal*, New York, Nov. 6), that, "among 103 children born of deaf-mute parents in Boston and vicinity, *only* 14 are deaf-mutes," naïvely ignorant that he is giving Dr. Bell heavy and effective ammunition.

But even with this unexpected aid from the opposing side, I do not think Dr. Bell's views are to be accepted as those which should govern the deaf, in all cases, in their choice of partners for life. Much less do I approve of the wholesale encouragement to deaf-mute intermarriages given by Dr. Gillett.

Were my advice sought by a young deaf-mute, heart-free, and untrammelled by any engagement, I should say that if he or she could marry, on a basis of sincere affection, one possessed of hearing, such a union would be far more to be desired than one with a deaf partner. Such a marriage as I would recommend first would do much towards taking the deaf partner out of the narrow circle of deaf-mute society, with which the deaf are too apt to be content; it would bring a most important element of comfort and practical assistance to the married pair; it would furnish an essential advantage in the training of the children and in the management of the household. But no argument ought to be necessary to prove that a family where one parent can hear has great advantages over one where both parents are deaf; and in the last analysis the interest of the family must take the precedence over that of the individual, for it is the family, and not the individual, that constitutes the unit of society. Many deaf-mutes think more happiness is to be found in a marriage with a deaf person than with one who hears; but this is by no means as certain as Dr. Gillett, or the deaf themselves, suppose, for it involves a question that has not yet been settled, and may never be. I have known some intermarriages of the deaf to result in wretched unhappiness, but I do not for that reason conclude that such marriages must always, or even often, be unhappy. It is undoubtedly true that some marriages of deaf people with those who hear have turned out badly, but Dr. Gillett's admission that he has known "most beautiful and happy unions of this kind" is a sufficient answer to all objection to such unions; and to his admission I may be permitted to add the testimony from experience, of both a son and a brother, that marriage between the deaf and the hearing may be entirely happy and essentially successful.

But I would not have my deaf friends who have intermarried feel that I am putting them under a wholesale condemnation by urging the union of the deaf with the hearing as the ideal marriage for them. I am perfectly aware that circumstances may arise under which it becomes extremely difficult for a deaf person *not* to take a deaf partner. I am old-fashioned enough to believe in falling in love, even in this mercantile age, and in remaining in love through long years of happy married life; and I should be the last to lay a rude hand on a tie that had grown up between two deaf young people which seemed likely to ultimate in that greatest of Heaven's boons, a marriage of sincere affection. In such a case my friendly advice would be to look well into the causes which made the young people deaf, and ascertain whether there was a family tendency towards the disability or not; and if it appeared that no such tendency existed, or that it was very slight, I certainly should not "forbid the bans."

If, on the other hand, such a condition in the families was disclosed as to render the birth of deaf children probable, a reason for hesitation would surely be recognized which every truly benevolent and unselfish mind would regard as serious.

I have several personal friends who have remained unmarried because of the existence in their families of certain mental or physical defects likely to descend to offspring; and as I honor them for their unselfishness, so would I rank high in my esteem a deaf person who lived single for a similar reason. But the consideration of this aspect of the question need not be extended: it can be dismissed with the advice to all young deaf people to look carefully into the matter of "family deafness" before their hearts become entangled with any one, and govern themselves accordingly, remembering all the time that their ideal marriage, because best for the family, is with one who hears.

Turning now to the second point proposed for consideration in this article, the education of the deaf, I desire to direct attention to several errors which have of late attained popularity and credence, as supposed truths, with many people: —

1. That the oral teaching of the deaf is a new method.
2. That all deaf children can be successfully taught to speak.
3. That under the oral method deaf children can be taught the vernacular use of language more easily and perfectly than under the manual method.
4. That the use of the sign-language is a hinderance to the best results in teaching the deaf.
5. That signs can and ought to be dispensed with in educating the deaf.
6. That the sign-language obtained a foothold in this country merely through accident.
7. That it is now dying out.
8. That the oral method is greatly superior to the manual, and is rapidly supplanting it.

So far from its being through accident that the sign-language obtained a foothold in this country, the facts are, that the founder of deaf-mute instruction in America, Thomas Hopkins Gallaudet, sought for many months in England to gain a knowledge of English methods of teaching the deaf which made little use of signs; that the schools of Great Britain were closed against him; that, while he stood patiently knocking at their doors, he met in London the distinguished French teacher of the deaf, the Abbé Sicard, and his talented pupil, Laurent Clerc; that on Sicard's invitation Mr. Gallaudet repaired to Paris, where he found the manual method of De l'Epée, which made free use of the sign-language, in most successful operation; that he acquired a knowledge of that method, believing, with good reason, that it was well adapted to secure the education of all the deaf; that he introduced that method into America, where it has been preserved from 1817 to the present time, with results to thousands of deaf children more beneficent and satisfactory, on the whole, than have attended the education of the deaf in any other country under any method.

The sign-language, far from dying out in this country, is to-day made use of in a greater number of schools, and with a larger number of pupils, than it has been in any year since its introduction seventy-three years ago.

The first oral school in America in which it was undertaken to dispense with signs was established in 1867, when the number of schools for the deaf was thirty. Since that time fifty-one schools have been established in the United States and Canada, having 2,157 pupils. In thirty-five of

these the sign-language is constantly and freely used as a means of instruction. In sixteen, the oral schools, with 777 pupils, the sign-language is said to be dispensed with in teaching, but is known to be largely used by the pupils when not under the surveillance of instructors or officers. In not one of the thirty schools existing previous to 1867, in which 5,869 pupils are now taught, has the use of the sign-language been abandoned. These thirty schools in 1867 had less than 3,000 pupils.

The latest statistics report 9,325 deaf children under instruction in the United States and Canada in eighty-one schools. The number of oral schools from which it is attempted, with partial success only, to exclude the sign-language, is eighteen, with 1,113 pupils,—less than one-fourth of the schools, and less than one-eighth of the pupils.

These facts certainly lead to other conclusions than that the sign-language is dying out in America, and that the oral method is supplanting the manual.

No error can be greater than the supposition that the judicious use of the sign-language is a hinderance to the best results in teaching the deaf. Proofs to the contrary abound in the history of the manual schools of America. The sign-language, far from being a hinderance, is a most important, valuable, and sometimes even an indispensable, adjunct in teaching; and, where well-trained and competent instructors are employed, the results are far more satisfactory than under the method which rigidly excludes signs; and it is not alone under the manual method or by manual teachers that the value of signs is recognized.

But before bringing forward the testimony of one of the world's most famous oral teachers of the deaf in favor of the use of signs, even in oral schools, I wish to direct attention to, and emphasize, the fact that those who are loudest in traducing the language of signs and in demanding its abolition from schools for the deaf, who assume to discourse learnedly as to its baneful effects, have never even attempted to learn it, and could not hold five minutes' conversation in it to save their lives; and yet their pupils know and use this language, and may insult or ridicule them in it under their very noses with impunity.

If one as ignorant of French or German as these critics are of the sign language should undertake to enlighten the world as to the effect on mental development of studying and using the language of France or Germany, I think the world would be apt to be amused.

In 1867 I made an extensive examination of the prominent schools for the deaf in Europe. Among others, I visited the renowned establishment at Weissenfels, an hour's ride from Leipzig, where the first oral school for the deaf was established, in 1772. At the head of this school I found Frederick Moritz Hill, then in his sixty-second year, and in the thirty-seventh year of his service as a teacher of the deaf under the oral method. As a writer of works relating to the education of the deaf, as a teacher of deaf children, and as a trainer of teachers, Hill occupies a place second to none among the instructors of the present century. In 1866 he published his most important work, "Der gegenwärtige Zustand des Faubstummen Bildungswesen in Deutschland," to which he called my attention as expressing views he had formed after nearly forty years of teaching.

From this work I will make a few extracts, giving the opinions as to the value of signs in the instruction of the deaf of a high priest of oral teaching in the land where oralism came into being, and where it has been universally upheld and practised, with all the success of which it is capable, to this day.

Speaking of those who pretend that in the "German method" every species of pantomimic language is proscribed, Hill says,—

"Such an idea must be attributed to malevolence or to unpardonable levity. This pretence is contrary to nature, and repugnant to the rules of sound educational science.

"If this system were put into execution, the moral life, the intellectual development, of the deaf and dumb, would be inhumanly hampered. It would be acting contrary to nature to forbid the deaf-mute a means of expression employed by even hearing and speaking persons. . . . It is nonsense to dream of depriving him of this means until he is in a position to express himself orally [p. 88]. . . . Even in teaching itself we cannot lay aside the language of gestures (with the exception of that which consists in artificial signs and in the manual alphabet, two elements proscribed by the German school),—the language which the deaf-mute brings with him to school, and which ought to serve as a basis for his education. To banish the language of natural signs from the school-room, and limit ourselves to articulation, is like employing a gold key which does not fit the lock of the door we would open, and refusing to use the iron one made for it. . . . At the best, it would be *drilling* the deaf-mute, but not *moulding* him intellectually or morally. Where is the teacher who can conscientiously declare that he has discharged his duty in postponing moral and religious education until he can impart it by means of articulation? Although the use of the language of pantomime acts in several respects in an unfavorable manner on the teaching of articulation, it ought to be remembered that institutions for the deaf and dumb are not created solely to impart this latter kind of instruction: their object is much more extensive, and they have to meet wants which depend on education taken in its entirety. It would therefore be a fault to exclude prematurely the language of natural signs [pp. 89, 90].

"I have always expressed myself thus when giving my exposition of the value and mode of applying, as a means of instruction, this language which we possess; and I have done this, I believe, without equivocation. I acknowledge in this language of natural signs —

"1. One of the two universally intelligible innate forms of expression granted by God to mankind,—a form which is in reality more or less employed by every human being.

"2. The only form of expression which by the deaf-and-dumb child can be fashioned without the aid of extraordinary practice, just as his mother-tongue suffices to the hearing child, eventually arranging itself into forms of thought, and unfolding itself into spoken language.

"3. The reflex of actual experiences.

"4. The element in which the mental life of the deaf-mute begins to germinate and grow,—the only means whereby he, on his admission to the school, may express his thoughts, feelings, and wishes.

"5. A very imperfect natural production, because it remains for the most part abandoned to a limited sphere of haphazard culture.

"6. A valuable mirror for the teacher, in which the intellectual standpoint of his pupil is exhibited to him.

"7. At first the only, and consequently indispensable, means of comprehension between teacher and pupil, but not a language which we merely need to translate into ours in order to induct him into the latter tongue.

"8. An instrument of mental development and substantial instruction, made use of in the intercourse of the pupils with each other; for example, the well-known beneficial influences which result from the association of the new pupils with the more advanced.

"9. A means, but not the only one, whereby to supply a lack of clearness in other methods of communication, and leading back, in extraordinary cases, to the real object, or to its representation in drawing or model.

"10. The most convenient, quick, and certain means, in many cases, of making one's self understood by deaf-mutes, whether during tuition or out of school hours, and therefore also employed, perhaps, very often without need, even without volition.

"11. A very welcome means of revisal and correction when articulation brings into use, for example, an ambiguous word.

"12. A most efficacious means of assisting even pupils in the higher degrees of school training, giving light, warmth, animation, to spoken language, which, for some time after its introduction, continues dull and insipid.

"13. A practicable means of communication with others beyond the walls of the deaf-and-dumb institution, whether it be used by itself or in connection with articulation."

Then, after extending somewhat the train of thought suggested by these clearly stated points, the author thus concludes what he has to say in this part of his book on the use of signs:—

"But it is particularly in the teaching of religion that the language of pantomime plays an important part, especially when it is not only necessary to instruct but to operate on sentiment and will, either because here this language is indispensable to express the moral state of man, his thoughts, and his actions, or that the word alone *makes too little impression on the eye of the mute* to produce, without the aid of pantomime, the desired effect in a manner sure and sufficient."

The only comments necessary on Hill's conclusive argument in favor of the sign-language are (1) that his single criticism in Paragraph 5 loses its weight altogether when manual or combined schools are considered; for in these the sign-language, far from being "abandoned to a limited sphere of haphazard culture," as is the case in the oral schools where it is used at all, has had a century and a half of careful and often scientific development, and now serves as a medium for expressing and receiving abstract ideas, the reckless statements of ignorant critics to the contrary notwithstanding; and (2) if "the imperfect natural production" employed in the German schools as sign-language deserves the high approval given it by Hill, what must be the value of the perfected ideographic language now used in the manual and combined schools, and among thousands of the deaf in this country, with great profit and the keenest pleasure?

The limits of this paper forbid even the briefest mention of the many reasons in favor of the use of the sign-language in the teaching of the deaf, which might be added to Hill's, from the points of view of the manualist instructor.

It remains only to allude to the very great error, that all deaf children can be successfully taught to speak, and then to add a few words concerning the system of instruction which includes all that is good in all methods.

That all, or nearly all, deaf children can be taught to speak, is not denied; but this is precisely as all normal children can be taught to draw or to sing. All normal children possess the power of producing musical tones, and of delineating the outlines of an object with a pencil. So all deaf children have the organs of speech and the power of producing articulate sounds.

Now, it is well known that very many normal children cannot succeed as artists or vocalists; and few would advise the teaching of art or music to such after it became clear that the talent for these accomplishments was lacking. Success in these lines does not come without effort, and seldom without long and severe training; while success in speaking comes to every normal child by mere association with his fellows, without effort and without special training.

To the totally deaf child success in speaking is attained under conditions not unlike those which attend normal children in their development of the art faculty. When this is absent, or present in a hopelessly weak degree, effort and training will yield only painful and disappointing results; and it is precisely so with certain deaf children who lack a faculty, to which no name has as yet been attached, the existence of which in others insures success in speech, to the joy of their teachers and the pride and delight of admiring friends.

In considering the case of the deaf learning to speak, it must never be forgotten that under no circumstances can they do this as normal children do, by association and without effort, but that in every case speech is an acquisition only possible with great and sustained effort on the part of the pupil, assisted by the skill, patience, and perseverance of able and competent teachers. If one will attempt to master the pronunciation of a foreign tongue, without ever hearing a word of the language spoken by another, he will appreciate, though only in a limited degree, the difficulties attending the acquisition of speech by the totally deaf.

In point of fact, a large proportion of the deaf children educated in oral schools utterly fail of any thing that can be called success in speech; and the value to such, of this imperfect utterance, always painful and often utterly without meaning to listeners, is as nothing when the labor, time, and expense of attaining it are considered.

But, worst of all, the claim that all the deaf can be successfully taught to speak is often flatly refuted by the conduct of those who make it. Cases have come under my own knowledge where admission to prominent oral schools has been denied to certain uneducated deaf children for the reason, given to their parents, that they would be unlikely to succeed in speech, and I have known these very children to be taught to speak in schools conducted under the combined system. Such inconsistency on the part of oral teachers, when known, cannot fail to impair confidence in every thing they may do or say. And this is not the only point in which the attitude of some of the most prominent promoters of oralism is open to condemnation.

Not long since, I received an application for the admission to our college of a young lady whose previous training had been in an oral school of good standing. Her preparation for college was not quite complete, and I suggested that she return to her school and secure the needed preparatory training, which could easily be given her there. Much to my surprise, the principal of this school, on learning of the purpose of the young lady's friends to send her to the college at Washington, not only refused to give any aid in preparing her to enter, but declared he would do every thing in his power to prevent her going to college; and the reason for this was simply because in the college the finger alphabet and signs are made use of, and speech (understood to be fully acquired in the schools) is not taught. Thus this principal of a great school was willing to sacrifice the only chance his "very bright pupil" (as he himself characterized her) had for securing the higher education, because of his hostility to the use of a language which his great master, Hill, regards as "a most efficacious means of assisting even pupils in the higher degrees of school-training."

I have alluded several times to the combined-system schools, in which more than seven-eighths of the deaf children now under instruction in America are to be found. In these schools the principle is recognized and acted on that no one method is suited to the conditions of all the deaf. With many the oral method fails; with some it succeeds; for a large proportion the manual method does not meet all requirements, nor develop all the powers; with a few the aural method is to be preferred to the oral or manual.

Those who sustain the combined system acknowledge the value of all these methods in their proper place, and in the institutions they promote endeavor to give to each method every possible opportunity for success. They advise that every deaf child should have a fair opportunity to learn to speak,—as in the community at large every child should have a chance to learn to draw and to sing,—but they advise with equal earnestness that time should not be wasted in trying to force birds to sing to whom nature has given only the ability to caw or to scream.

Ten years ago there was held at Milan an international convention of instructors of the deaf, at which were presented some notable results of oral teaching in the schools of Milan. The convention was wholly in the hands of partisans of the oral method, and they succeeded in securing the passage of certain resolutions giving a preference for the oral method, which were trumpeted over Europe, and were not without influence even in this country. The effect of this was revolutionary in France and Great Britain, and the cause of oralism made rapid advances during the first half of the decade just closed. In England, however, the progress of oral teaching has received a decided check.

In 1885 the Queen of England appointed a commission, with the Duke of Westminster at its head, who was later succeeded by Lord Egerton of Tatton, with such men upon it as Sir Lyon Playfair, Mr. Mundella, Drs. Armitage and Campbell, and others less known in America, but of equal distinction in their own country, whose duty it was to inquire carefully into the methods of educating the deaf, the blind, and the idiotic, with a view of securing much needed parliamentary aid.

The labors of this commission covered a period of more than four years, during which time the promoters of oralism brought every possible influence to bear to secure the approval of their method and the condemnation of all others. They failed in this. While the commission recommended giving every deaf child an opportunity to learn to speak, they recognized fully that many would not succeed, and that for these other methods of teaching must be employed.

But a more decided support to the combined system comes from England as recently as the last month. Benevolent persons interested in securing the establishment of a new school for the deaf at Preston, for north and east Lancashire, formed a commission of four able men, who examined very carefully the most prominent schools in England of all methods. This commission in their report, made Oct. 8, 1890, recommend most strongly a dual or combined system, declaring that "pure oralism is an idea, not a reality; a useless task to dull pupils; unsatisfactory for a large number of pupils; entirely successful only in exceptional cases and under conditions that are generally impracticable and often impossible."

Such opinions, reached after the careful and impartial examination of intelligent men, interested to arrive only at the truth, ought, it would seem, to be accepted as conclusive.

EDWARD M. GALLAUDET.

## WORK AT THE NEW YORK STATE AGRICULTURAL EXPERIMENT STATION.[1]

THE work now in charge of the first assistant is as follows:—

1. *Experiments with Swine.*—So soon as enough skim milk, etc., is available, it is expected to conduct the pig-feeding in connection with the dairy cattle experiments, and comparison of the different breeds of swine will be made. For the present the experiments are confined principally to feeding of various coarse foods that have been used and recommended for swine; e.g., corn-ensilage, sorghum, prickly comfrey, beets, clover and clover ensilage, etc.

2. *Experiments with Poultry.*—Feeding-experiments with rations more and less nitrogenous have been made with young and mature laying stock; and these experiments extend always throughout the whole laying season, some of both large and small breeds being used. Feeding-experiments are being made, and have been, with capons and cockerels. Experiments have been made with home-made and inexpensive incubators and brooders, and it is expected to continue them. Preparations are now nearly completed for breeding-experiments with tested individuals of several breeds. Considerable chemical work has been done, and experiments are now (although temporarily interrupted) in progress to answer the question definitely whether inorganic material, as stone, oyster-shells, etc , can supply lime for the egg shell. Experiments to ascertain the cost of production and value of product, in rearing chicks of different market breeds from the shell, under different foods and methods of hatching and brooding, are expected to be undertaken.

3. *Soil Experiments.*—The laboratory work on soils has been for the present discontinued, but only from pressure of more immediately necessary work. In the field, application of several cheap chemicals has been made; viz., sulphate of soda, sulphate of lime, sulphate of magnesia, sulphate of iron, carbonate of lime, common salt. The effect on the crop and soil is studied. These have only been applied one season, but it is intended to repeat the application several years on the same strips of soil under different crops.

4. *The Investigation, Selection, and Acclimatizing of Sorghums.*—Of the two or three hundred samples of seed, representing a hundred and fifty or more varieties that have been grown during the last three seasons, less than a dozen have been selected for

[1] From the Geneva Gazette, Nov. 14, 1890.

future use as of value in this State. Among these, however, are some very promising varieties. This necessitates, besides work in the field, much chemical work, analyses of juices, etc.

5. It is also proposed to enter upon another line of work with our pasture and meadow grasses,—the selection, preservation, and propagation in absolute purity, by sod-culture and seed, of the most vigorous and hardy strains and individuals of the most valuable varieties. It is hoped to establish the better types as standard by co-operation with some other stations, and to supplant the degenerate varieties so largely used.

Maps, charts, plans, and drawings for purposes of illustration of station work, have also been made.

In the chemical department the following work is in hand: 1. Analysis of milk of registered cows undergoing experiment (this work involves at present the complete analyses, each week, of from ten to fourteen samples of milk, and the extent of the work will increase until the whole herd is in milk); 2. Analysis of skim milk, buttermilk, and butter, in connection with the foregoing, requiring at present from fifteen to twenty-one analyses each week; 3. An extended investigation into various methods of creaming, requiring at present seven analyses each week, but soon the work will be increased threefold; 4. Analyses of all the feeding-stuffs connected with various experiments being carried on at the station; 5. Analysis of fertilizers in accordance with the recent law establishing a fertilizer-control at the station; 6. An investigation into the influence of acidity of cream upon the quantity and quality of butter produced; 7. Experiments relating to a more accurate method for the determination of fat in feeding-stuffs; 8. Experiments relating to a simple method for the determination of nitrogen in nitrates; 9. Analysis of various things sent to the laboratory from different parts of the State.

The work being carried on in the horticultural department is a continuation of that of last season, with the addition of such other lines as have been thought best. The leading features are (1) tests of the novelties in vegetables as to their desirability and commercial value; (2) tests of vegetable seeds, especially cauliflower and cabbage, to ascertain the value of American-grown seed as compared with imported seed; (3) the acclimatization of vegetables not native to this climate, notably the sweet-potato, with which very successful results have been obtained; (4) the forcing, under glass, of such vegetables as seem best adapted for that purpose; (5) tests of varieties of small-fruits, which consist in the study of the varieties as to their commercial value and adaptability to the climate of this State; (6) also, so far as facilities offer, work in cross-fertilization, tending to the improvement of varieties and the special study of pollen influence. This line of work is of very great value, and a large part of the greenhouse has been set apart for the continuation of it through this coming winter, as there are, from the results of last winter's crossing, over one thousand seedlings to be tested; and the data, if as valuable as expected, should be before the public as soon as possible.

The above is in connection with the daily routine of note taking, and records made of the planting, germination, growth, habit, blossoming and fruiting season, of all plants in this department, a large number of which notes are merely for reference, and are only inserted in our record books, making no showing that would lead the public to know what a vast amount of constant painstaking work is necessary to keep records that become of greater value year by year.

In the pomological department the testing of the large fruits and of the varieties of grapes is being carried on as heretofore, and a study made of their habits of growth, vigor, susceptibility to disease, hardiness, and adaptability to this climate; also of the diseases affecting the different fruits, especially the grape. Experiments are being continued with fungicides and insecticides, with the object of obtaining simple and effective remedies for the holding in check or entirely ridding our orchards and vineyards both of fungi and the insect pests that are rendering such a large proportion of our fruit worthless. A more extended line of experiments is being planned for the coming year, intended to embrace a larger field; and some of them will be carried outside the station limits through the courtesy of nurserymen and fruit-growers, a number of whom have offered to place the necessary land and stock at the disposal of the station. It is intended that a portion of this work shall be devoted to experiments with fertilizers. In connection with this, an object-lesson in the chemical composition of the ash of four leading fruits (apple, pear, plum, and cherry) and of two of the woods (grape and apple) has been prepared, showing the amounts of the different fertilizing and mineral elements removed from the soil by the growth of 150 pounds of each of the fruits named, also by 100 pounds of the wood of the grape and apple. It is intended for use at the fairs, farmers' clubs, and meetings of fruit-growers, and for use at the station.

As a portion of the general farm-work has been included in this department, a considerable amount of routine work has necessarily to be performed. Experiments have also been started with cereals and grasses, to test varieties and methods of seeding. Others are planned with fertilizers, ensilage, crops for soiling, and methods to obtain the best and most economical results.

In addition to the above regular and systematic work of investigation going on at the station, there have been published during the past year, in addition to an annual report of several hundred pages, seven bulletins with an aggregate of 173 pages, 45,000 copies of which, in all, have been distributed among the farmers of the State; while the correspondence has steadily and rapidly increased from a total of less than 500 letters in 1887, to over 2,000 during the past year, many of these letters of inquiry necessitating study and investigation.

## NOTES AND NEWS.

THERE are few injurious insects for which more remedies and preventives have been recommended than for the striped cucumber beetle, — the everywhere abundant yellow "bug" with black stripes along its back, which attacks squashes, cucumbers, melons, and in fact nearly all cucurbitaceous plants. A large portion of these remedies are doubtless worthless, if indeed not positively injurious. In order to get a more definite knowledge of the preventive or remedial value of these various substances, the Ohio Experiment Station began last season a series of experiments in which it is designed to give each a practical field test, and, if possible, to arrive at some reliable conclusions for the guidance of the interested public. The results of last year's work showed that many of the so-called remedies are worthless, some even being worse than the disease. The experiments were continued this year on an extensive scale. A field of two acres was put in good condition by the use of plough and harrow, and was planted to squashes, melons, and cucumbers according to the ordinary plan of growing these vegetables. The seeds came up early in June, and the first striped beetles appeared soon after. They then came in great numbers, and destroyed a large number of plants before they could be treated. Two general methods of treatment were employed: (1) coating the plants with poisonous substances, and (2) fencing out the insects by mechanical barriers. The best success was attained in the first class of remedies by the use of tobacco-powder,— the refuse packing of the cigar-factories. A number of barrels of this substance were obtained at a cigar-factory. A shovelful of the powder was thrown on each hill. The first application was made to eighty hills, June 12. Rains coming soon after, it was repeated June 14, 16, and 17. The results were excellent. The beetles seemed to dislike working in the tobacco, and the plants on all the hills so treated came through in good condition. Aside from its value as an insecticide, the tobacco acts both as a mulch and fertilizer. Chemical analysis shows that its value as a fertilizer is twenty five dollars per ton. In many Eastern cities it is being utilized, but in Columbus and other Ohio cities many of the factories are glad to give this refuse to any one who will take it away. Various methods of mechanical exclusion of the beetles were again tried with good success. This may be done by simply placing over the plants a piece of thin plant-cloth or cheese-cloth about two feet square, and fastening the edges down by loose earth. It is better, however, to hold the centre of the cloth up by means of a half barrel-hoop, or wires bent in the form of a croquet arch. It is frequently stated that

these beetles will not attack plants if simple frames, consisting of four pieces of boards nailed together, without a top of any kind, are placed over the hills. This method was tried with a number of frames ranging from four to ten inches in height. As antici pated, the method was entirely unsuccessful, every plant of the hills so covered being destroyed by the beetles.

— The next meeting of the American branch of the Society for Psychical Research will be held at the rooms of the Boston Society of Natural History, corner of Berkeley and Boylston Streets, on Tuesday, Dec. 2, at 8 P.M. The secretary will give an account of some cases recently received or investigated, and make a report of some sittings with Mrs. Piper in England, by Professor Oliver Lodge, F.R.S. No admittance except by ticket, which may be obtained by members or associates on application to the secretary, Richard Hodgson, 5 Boylston Place, Boston, Mass.

— The new building for the Philadelphia Polyclinic and College for Graduates in Medicine will be ready Jan. 1, 1891, and will provide accommodations for the Polyclinic, or college departments, the Polyclinic Hospital, the Ladies' Aid Society of the Polyclinic Hospital, the Polyclinic Medical Society, and the Polyclinic Medical Library. Since 1882 post-graduate medical schools have been established in New York, Chicago, Baltimore, Cincinnati, St. Louis, New Orleans, and Boston. With the single exception of the Johns Hopkins University, all occupy modified old buildings, while this new building is especially adapted from a personal knowledge of the requirements acquired in the old, long-established, and largely endowed institutions of Europe, and arranged by the architects, Messrs. Baker & Dallett. The special features of this new structure are, first, that it has been built to meet the requirements of combining in one institution all of the peculiar advantages to be derived from those hospitals which are devoted to the treatment of a single class of diseases, known as special hospitals; second, the building is arranged to facilitate carrying out the essential character of practical teaching, in which pupils who are practitioners of medicine may be brought in classes, which are always limited in number, into direct contact with the patients. The building is constructed of brick and terra-cotta. The system of heating is by indirect radiation. Incased steam-coils are placed in the cellar, and there heat the pure air brought in by conduits. Other conduits conduct the heated air to the rooms and hallways. Ventilation is accomplished by substratum suction. The exit registers are placed in the walls near the floors, and in proper relation to the position of the hot-air registers. The impure air is carried down to the air-tight ducts under the cellar floor, and passes out above the roof through the high brick stack. In the centre of this stack is a cast-iron pipe, through which passes the gaseous products of combustion from the engine-room. The constant heat in this iron pipe maintains an upward current of air around it inside of the brick stack. This system is arranged to permit the addition, at trifling expense, of an electrical or steam blower, should this be found necessary. All the corners in the building are rounded, to prevent the accumulation of dust and to facilitate thorough cleansing. The elevator shaft, iron stairs, and all toilet-rooms are placed in a practically detached building, which greatly enhances the sanitary condition. City gas has been introduced throughout, but it is contemplated introducing an electric-light plant as soon as funds can be obtained. Varnished natural wood is used throughout the interior, paint being used on the exterior only. The future success of this institution, which is the only one of its kind in Pennsylvania, depends entirely upon the financial support given to it by generous-hearted citizens. It is a matter of experience that charitable and educational institutions are successful in proportion to their endowments. None are self-supporting. The higher medical education of the physician affects the entire community, each and all being subject to illness and accident, each and all desiring above all things a speedy recovery of health. This is materially aided by the Philadelphia Polyclinic, which is the only post-graduate medical college and hospital in Pennsylvania. The endowment of scholarships will permit the awarding of the unique facilities of The Polyclinic to deserving physicians of limited means, as, for example, medical missionaries, or the extending similiar privileges to the medical staff of the army and navy. The endowment of departments will provide the elaborate and often expensive apparatus required by all. The endowment of free beds increases the charitable work.

— The proceedings of the twenty-third annual meeting of the Kansas Academy of Science, held at Lawrence, Nov. 5, 6, and 7, were as follows: Wednesday at 5 P.M. business meeting at the Eldridge House, at 8 P.M. public lecture in Snow Hall by the retiring president, Professor G. H. Failyer; Thursday at 9 A.M. and 3 P.M. meetings for the reading of papers in Snow Hall, at 8 P.M. a reception to visiting members, tendered by the University Science Club; Friday at 9 A.M. and 3 P.M. meetings for the reading of papers, at 8 P.M. an exhibition of lantern and microscopic slides in the University Chapel. The following papers were read, some being by title only: "Observations on the Nutation of Sunflowers," and "Germination of Indian-Corn after Immersion in Water of Different Temperatures," by W. A. Kellerman; "Periodicity in Plants," and "Additions to the Flora of Kansas," by B. B. Smyth; "Plants of the Colorado Boundary," and "Notes on Southern Kansas Plants," by M. A. Carlton; "Equation of the Mean Monthly 21-Year Temperature Curve of Lawrence, Kan.," by E. C. Murphy; "Annual Precipitation of Rain and Snow at Manhattan, Kan., for the Past Thirty-two Years (Chart)," and "Mean Hourly Velocity of Wind at Manhattan, Kan. (Chart)," by C. M. Breese; "An Electrical Hygrometer," by L. I. Blake; "On the Relative Sweetness of the Different Series of Alcohols," by E. E. Slosson; "The Selective Power of the Sense of Taste," by E. H. S. Bailey; "The Sugars of Watermelons," by J. T. Willard; "Notes on Sugar Beets," by G. H. Failyer and J. T. Willard; "Some Notes on Kansas Meteorites," by F. H. Snow; "Notes on Kansas Salt Marshes," by Robert Hay; "Evidences of Prehistoric Man in Labette County, Kan.," by W. S. Hill; "Notes on Some Fossils of Lincoln County, Kan.," by D. S. Kelley; "A Comparison of Preservative Fluids for Museum Use," by V. L. Kellogg and E. E. Slosson; "Notes on Summer Birds of Estes Park, Colorado," by V. L. Kellogg; "On the Skull of Discosaurus," by S. W. Williston; "The Civilization of the Mound-Builders," by H. C. Fellow; "Evolution of the Human Face," by A. H. Thompson; "Equal and Unequal Taxation," by J. H. Carruth; "On the Valuation of Mustard from an Estimation of its Sulphuretted Oil," by L. E. Sayre; "Notes on Kansas Minerals," by G. H. Failyer; "Analysis of 'Feather Alum' from Colorado," by E. H. S. Bailey; "On the Most Economic Process for the Manufacture of Iodoform," by S. R. Boyce; "A New Siphoning Extraction Apparatus," by G. H. Failyer and J. T. Willard; "Radiation of Heat from Foliage," by A. G. Mayer; "A New Fire-Screen," and "Notes on the Thermal Resistance of Fire-Screens," by T. H. Dinsmore; "First Addition to the List of Kansas Peronos Peraceæ," by W. T. Swingle; "Preliminary Notice of Some Kansas Rolling Plants," by W. T. Swingle and D. G. Fairchild; "Harmonic Forms," by B. B. Smyth; "On Certain Generic Characters of Tachinida," by S. W. Williston; "The Flora of Cherokee County, Tex.," by Mrs. A. L. Slosson; "Evolution in Leaves," by Mrs. W. A. Kellerman; "Notes on the Grasses found in the Vicinity of Manhattan," by W. A Kellerman and Bessie Little; "Note of the Precision of the Solar Attachment," by F. O. Marvin; "Preparation for Scientific Work," by T. H. Dinsmore; "Structure of the Kansas Chalk," by S. W. Williston; "Notes on Sorghum Smuts," by W. A. Kellerman and W. T. Swingle; "Notes on the Distribution and Ravages of the Hackberry Knot," by W. A Kellerman; "Methods of Collecting, Cleaning, and Mounting Diatoms," by Gertrude Crotty; "The Union of Cuscuta Glomerata with its Host," by W. C. Stevens; "On the Best Gun for Collecting Naturalist," by J. J. Graham; "Note on the Occurrence of Mammoth Remains in Franklin County, Kan.," by O. C. Charlton; "On the Action of the Pasteur Filter on a Solution containing Bacteria," by L. E. Sayre and V. L. Kellogg; "Differentials of Higher Orders than the First," by E. Miller; "Certain Curves and Surfaces derived from Surfaces of the Second Degree," by H. B Newson; "Camp of Prehistoric People found near Wichita, Kan.," by J. R. Mead; "Experiments in 1890 for the Artificial Dissemination of the Chinch-Bug Disease," by F. H. Snow; "Note on an Insect found in Flaxseed," by D. S. Kelley.

# SCIENCE:

*A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.*

PUBLISHED BY

N. D. C. HODGES,

47 LAFAYETTE PLACE, NEW YORK.

SUBSCRIPTIONS.—United States and Canada.. .....$3.50 a year.
Great Britain and Europe..... 4.50 a year.

Communications will be welcomed from any quarter. Abstracts of scientific papers are solicited, and twenty copies of the issue containing such will be mailed the author on request in advance. Rejected manuscripts will be returned to the authors only when the requisite amount of postage accompanies the manuscript. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a guaranty of good faith. We do not hold ourselves responsible for any view or opinions expressed in the communications of our correspondents.

Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

VOL. XVI. NEW YORK, NOVEMBER 28, 1890. No. 408.


## CONTENTS:



## LETTERS TO THE EDITOR.

**** *Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

*The editor will be glad to publish any queries consonant with the character of the journal.*

*On request, twenty copies of the number containing his communication will be furnished free to any correspondent.*

### Right-handedness and Effort.

PROFESSOR JAMES replies in *Science* for Nov. 14 to my letter in the issue of Oct. 31, taking exception to my interpretation of my baby's use of her right hand only for strong efforts. Without summarizing the points at issue, I may indicate where it seems to me his explanation lacks force.

In the first place, I agree with him in all that he says about a "natural prepotency in the (brain) paths to discharge into the right arm." This is undoubtedly the explanation of right-handedness, as my observations would indicate as far as they go. I also agree with him in casting out the view that brings in conscious distinct memories and choices. They are a later development. There is nothing in my letter to indicate such a view. On the contrary, I accept the "semi-reflex" theory of the possibility of the use of either hand. But quite apart from these facts of the nervous basis, the question arises: What is the least difference in consciousness required to explain the preferential use of the right hand when effort is involved?

Now, Professor James kindly says that my observations "show how strong stimuli may produce more definitely localized re-actions than weaker ones. The baby grasped at bright colors with the right hand almost exclusively." So far clear enough. But whenever the same stimulus, say a piece of common newspaper, was used in two experiments, at ten and at fourteen inches distance respectively, the same "more definitely localized re-action" took place in the second case; but in this latter case the stimulus which produced this "more definitely localized re-action" was fainter, being farther away, and the other conditions being the same in the two experiments. The child always used the right hand for long distances, even when the objective amount of stimulus remained the same. The least inference, I think, is that the intensity of the stimulus is not, at any rate, the exclusive cause of the more definite re-action. Greater intensity might account for the use of the right hand in some cases, but we certainly cannot hold at the same time that lesser intensity accounts for it in others.

The new element must represent the influence of former experience. I see no way to avoid this alternative. This is what I meant by "memories," merely some kind of a conscious modification which alters future re-actions. A purely physical modification would not suffice, for it would have its full force also in cases which involved no effort. Now, we may hold that such "memories" are exclusively of afferent nerve processes, or that they involve also a conscious modification due to efferent nerve processes. If the former, we may attribute them to the greater "promptitude, security, and ease" of right-hand movements, as Professor James suggests, or to former movements of the eyes, involved in the visual estimation of distance (which I am astonished he does not suggest) The first alternative, which Professor James asks my ground for rejecting, is inadequate for the following reasons. If such memories of afferent processes be of movements with effort, they are already right-handed, and the question is only thrown farther back; but, if they be of effortless movements, then their motor influence would be perfectly indifferent, as I said in my former letter. My experiments show this. If there had been differences in "promptitude," etc., the child certainly would have shown preference for the right hand in effortless movements during the latter six months of the first year. But, on the contrary, it was only when making violent effort that there was any preference at all. Even after she developed such preference in cases of effort, the use of her hands when no effort was required continued to be quite indifferent. Does not this indicate that the traces left by former afferent processes of the same sense are not sufficient?

Moreover, in the absence of all feeling of the efferent current, what could sensations of "promptitude," etc., be but the consciousness of better adaptation and co-ordination of movements? But at this stage of life all the child's movements are so ataxic, that there seems to be no practical difference between the two hands in regard to the lack of the tactile delicacy in which pathological cases show motor ataxy to consist.

If we seek for the needed "memory" among the sensations of eye-movements in the case where the stimulus is weaker (more distant), it is possible that we may find an afferent element which brings up the intensity of the hand-memories to the necessary pitch. There may be a connection between the centres for feelings of eye-movement and feelings of hand movement, so that their united "dynamogenic" influence is the same as the high intensity of the color stimulus. But, while freely admitting such a possibility, it only pushes the question farther back again; for how do we know that these eye-memories do not involve consciousness of the efferent process which innervates the eye-centre? And, besides this, there is another element in the hypothesis that afferent elements from other senses may furnish the "kinæsthetic co-efficient" for a given voluntary movement; namely, that such activities of the other senses invoked took place along with movements of the attention, which might, and probably do, contribute an efferent element to consciousness. This possibility I have never seen anywhere recognized.

But in this case my experiments show conclusively that eye-movement memories did not re-enforce the intensity of the arm-movement memories; for, when the distance was more than fourteen

inches, the re-action was inhibited altogether. The distance of the stimulus as apprehended by the eye, therefore, instead of giving the increased motor excitement which we require, rather diminishes it, and makes the need for some other explanation all the more imperative.

It appears, therefore, that the element needed in consciousness to explain the facts cited in my former letter is some kind of a difference in sensation corresponding to the outgo of the nervous current into the right arm, be it as vague, subconscious, and unworthy of the name of "memory" as you please; that is, I still think that my experiments support the traditional doctrine. On any other theory, right-handedness would have been developed independently of effort. J. MARK BALDWIN.

Toronto, Ont., Nov. 18.

## Mount St. Elias.

IT is with great reluctance that I return to the subject again, but I beg to be permitted two statements in regard to the matter recently a subject of discussion between myself and Professor Heilprin in your columns.

In the first place, I did not "unfavorably criticise" Professor Heilprin's "work in Mexico." I merely pointed out that he assigned a weight to the observations which his equipment afforded which that class of instrument (viz., a pocket aneroid) is not entitled to, and that the result of such observations (as to the accuracy or inaccuracy of which I raised no question) is not determinative within the limits he assumed.

In the second place, discussion, in order to be profitable, especially in such matters as measurements and methods, must be just and accurate as well in the representation of an adversary's position as in the statement of one's own. In cases where the mutual recognition of this obvious truism is impracticable for any reason, I feel that it is better to cease the discussion, even though it leaves me apparently worsted in the argument. As a matter of fact, Professor Heilprin's understanding of the work printed in the St. Elias report ("Coast Survey Report for 1875") is hopelessly inaccurate and confused; and to that report, therefore, I refer those who are competent to judge of such matters, and may care to possess themselves of the facts in the case.

WM. H. DALL.

Smithsonian Institution, Nov. 22.

## Annular Phase of Venus.

AN opportunity of observing an unusual, if not remarkable, phenomenon will soon occur; and I wish to call the attention of astronomers to it, as another opportunity will not present itself until after the lapse of eight years. This phenomenon may be conveniently called the annular phase of the planet Venus, though it be produced not by reflected light only, as in the ordinary phases of the moon, but partly also by the refracted light of the sun, which has passed through the planet's atmosphere. This phase I unexpectedly witnessed twenty-four years ago under the following circumstances: —

I desired to observe the prolongations of the cusps of the crescent of light, mentioned by several writers, and which I afterwards found had been observed by Mädler in May, 1849, and used by him to obtain the amount of refraction in the atmosphere of Venus; but I had not then read his paper on the subject and was unacquainted with his formulæ.

It was well known, that, if Venus and the earth at any time occupied certain relative positions in their orbits, they would return very nearly to the same points, after an interval of eight years less two and a half days. It was also well known that Venus would transit the northern part of the sun during the forenoon of the 9th of December, 1874 (civil day at Greenwich), and would transit the southern part eight years less two and a half days later, or during the afternoon hours of the 6th of December, 1882. It was therefore evident that it would pass north of the sun, and very near it, eight years less two and a half days before the first of these transits, and would approach nearest to the sun about 2 P.M. (Greenwich time) on the 11th of December, 1866, least distance of centres being about 38′ of arc. I therefore prepared to observe the planet on the forenoon of that day.

My observations were made in the open air, on the grounds of the College of Charleston, with a telescope presented to the college many years ago by William Lucas, Esq. This telescope is a refractor by Troughton & Simms, 5 feet focal length, 3¾ inches aperture, eye pieces used magnifying 70 and 120 diameters. I so placed my telescope that the apex of the north gable of the library building, 23 yards distant, screened its object-glass from the rays of the sun; and the planet was easily found and distinctly seen above the roof of the library, least distance of nearest limbs about 22′. To my surprise, even astonishment, I saw not merely two cusps prolonged, but the whole circumference completely enlightened, the disk of the planet surrounded by a ring of light, broadest on the side nearest to the sun, narrower but quite bright on the opposite side. To have additional testimony to this fact, I immediately called to witness it Messrs. E. T. Frost and W. St. J. Jervey, two students in my astronomical class. They at once recognized the illuminated circumference, and said that it resembled in form the annular eclipse of the sun in October, 1865, which they had seen in this city in the preceding year. As said above, I was at this time unacquainted with Mädler's observations and formulæ, and, not having seen any intimation of the possibility of such a phenomenon, it took me wholly by surprise. I continued to watch the planet from 9 to 11 A.M., when the library building ceased to be available as a screen. This interval includes the instant of nearest approach of centres, which occurred about 9.30 A.M., Charleston mean time.

As far as I can learn, the only other persons who saw the phenomenon at that time were Professor C. S. Lyman of New Haven, Conn., and a few of his friends. In his equatorial of 9-inch aperture he saw the annulus or ring on the 10th completely formed; but the line of light on the side farthest from the sun was slender, faint, and only seen by glimpses. He saw it again on the 12th, but did not attempt to observe it on the 11th, the day of conjunction, when I saw it as a brilliant ring of light. He doubtless would have succeeded perfectly if he had abandoned the equatorial, which could not be screened, and used a more portable telescope, with some building as a screen.

In 1874 I watched the planet at intervals from the 30th of November to the 12th of December, the transit taking place on the night of the 8th and 9th, Charleston civil time. On the 2d of December I saw for the first time during this interval the distinct prolongation of the cusps, and watched their increase from day to day until the 8th, making eye-estimates of the number of degrees in the enlightened portion of the circumference, as I had not efficient means for making micrometer observations. On the 8th and the 9th I fully expected again to see the annular phase, but failed entirely to find the planet on both days. There were no clouds, at least not sufficient to entirely prevent observations, but there was a dense haze, and the region near the sun was strongly illuminated.

At this transit Mr. Lyman was more successful than myself, making good micrometer observations of the enlightened portion of the circumference, and seeing distinctly the illuminated ring on the 8th, the day before the transit. On the 9th he was, like myself, wholly unsuccessful in finding the planet, but on the following days continued his micrometer measures. The results of these observations he published in the *American Journal of Science and Arts* for January, 1875, with the amount of refraction in the atmosphere of Venus deduced from his observations, and also Mädler's formulæ by which it was deduced.

In December, 1882, the weather was so unfavorable on the day of the transit, the 6th, and for several days preceding and following, that I made no attempt to observe it before and after conjunction, and no accounts of the observations of others have reached me; but the scientific periodicals to which I have access are so few, that it would be unwarrantable to say that none have been made.

The next opportunity for observation will occur eight years less two and a half days after the last transit, that is, on the 3d of December next, when the least distance of centres will be about 35′, at about 5.30 P.M., Greenwich civil time. As Venus will

pass south of the sun, it will not be so easy to use buildings as screens in the northern hemisphere, and special means must be devised. The luminous ring will be as bright and conspicuous as in 1866, and the first appearance of the prolongation of the cusps may be looked for about the 24th of November.

It is now evident that similar opportunities will happen on the 1st of December, 1898, when least distance of centres will be about 1°, and about the 28th of November, 1906, when least distance of centres will be about 1½°, the planet in both cases south of the sun. In each case the least distance of centres will be less than the limit within which the formation of the luminous ring is possible, but the duration of the ring will be successively less as the least distance between centres becomes greater. No other opportunities will present themselves until near the end of the next century, when they will occur in June.

Similar opportunities must have occurred in years preceding 1866; that is, on the 14th of December, 1858, and also on the 16th of December, 1850; but it does not appear that either was used. This last date is only nineteen months after Mädler's observations in May, 1849; and, if any one properly situated as to time had endeavored to repeat Mädler's observation on the day of conjunction, he would almost certainly have seen the luminous ring.

LEWIS R. GIBBES.

Charleston, S.C., Nov. 13.

## A Problem in Physics.

AN experiment was tried by Joule nearly fifty years ago which has attained a world-wide reputation, and which has crept into nearly every text-book of physics. The commonly accepted interpretation of it, however, would seem not entirely satisfactory. I will quote from Tait's description of the experiment.

"Joule took a strong vessel containing compressed air, and connected it with another equal vessel which was exhausted of air. These two vessels were immersed each in a tank of water. After the water in the tanks had been stirred carefully, . . . a stop-cock in the pipe connecting the two vessels was suddenly opened. The compressed air immediately began to rush violently into the empty vessel, and continued to do so till the pressure became the same in both; and the result was, as every one might have expected, that the vessel from which the air had been forcibly extruded fell in temperature in consequence of that operation. It had expended some of its energy in forcing the air into the other vessel; but that air, being violently forced into the other vessel, impinged against the sides of that vessel, and thus the energy with which it was forced in through the tap was again converted into heat. On stirring the water round these vessels, after the transmission of air had been completed and the stop-cock closed, Joule found that the number of units of heat lost by the vessel and the water on the one side was almost precisely equal to the quantity of heat which had been gained on the other side." Tyndall gives the following (let *B* represent the vessel in which the air was compressed to 22 atmospheres, and *A* the vessel which was exhausted): —

"Now, the air, in driving its own particles out of *B*, performs work, . . . and the air which remains in *B* must be chilled. The particles of air enter *A* with a certain velocity, to generate which the heat of the air in *B* has been sacrificed; but they immediately strike against the interior surface of *A*, their motion of translation is annihilated, and the exact quantity of heat lost by *B* appears in *A*. The contents of *A* and *B* mixed together give air of the original temperature. There is no work performed, and there is no loss of heat." Tyndall gives an illustration of a cylinder having a piston in the centre, and the space above the piston a vacuum. Suppose the air below the piston is heated up from 0° to 273° C. "If the pressure were removed, the air would expand, and fill the cylinder. The lower portion of the column would thereby be chilled, but the upper portion would be heated; and, mixing both portions together, we should have the whole column at a temperature of 273°. In this case we raise the temperature of the gas from 0° to 273°, and afterward allow it to double its volume. The temperatures of the gas at the beginning and at the end are the same as when the gas expands against a constant pressure, or lifts a constant weight; but the absolute quantity of heat in the latter case is 1,421 times that employed in the former, because, in the one case, the gas performs mechanical work, and in the other not."

The following quotation is from Balfour Stewart, and bears upon this question: —

"The prevalent idea is, that when air expands it becomes colder, and that when condensed it becomes hotter; but Joule, by experiment, has shown that no appreciable change of temperature occurs when air is allowed to expand in such a manner as not to develop mechanical power. It follows as an inference, that, when air is compressed, the rise of temperature is scarcely at all due to the mere diminution of the distance between the particles, but almost entirely to the mechanical effect which must be spent on the air before this condensation can be produced."

A final quotation is taken from Ganot's "Physics:"—

"A strong metal box is taken, provided with a stop-cock, on which can be screwed a small condensing-pump. Having compressed the air by its means as it becomes heated by this process, the box is allowed to stand for some time, until it has acquired the temperature of the surrounding medium. On opening the stop cock, the air rushes out; it is expelled by the expansive force of the internal air: in short, the air drives itself out Work is therefore performed by the air, and there should be a disappearance of heat; and, if the jet of air be allowed to strike against a thermopile, the galvanometer is deflected, and the direction of its deflection indicates a cooling. . . . Joule placed in a calorimeter two equal copper reservoirs, which could be connected by a tube. One of these contained air at 22 atmospheres; the other was exhausted. When they were connected, they came into equilibrium under a pressure of 11 atmospheres; but, as the gas in expanding had done no work, there was no alteration in temperature."

I have given these quotations rather freely from standard authors, in order to present the problem as clearly as possible. In order to arrive at just the action taking place in this experiment, it seems to me a phenomenon first described by Faraday in 1827 should be mentioned. Gas compressed to 30 atmospheres was allowed to suddenly enter a cylinder 30 feet long, in which the gas was at atmospheric pressure presumably. It was found, that, where the gas rushed in, the cylinder was much cooled, while at the other end it was heated. It would seem that in this case the heating was not produced by the particles of gas impinging upon the end of the cylinder. If a piston were placed in front of the expanding gas, the whole of the gas on the other side of the piston would be compressed and heated. If, now, instead of a piston, we open a stop-cock at the end of the cylinder, the gas would stream in and compress that already there, and heat it; but the gas, expanding violently as it enters, would be much cooled, and this would more than counteract the heating where it enters. Thus the farther end would show a heating, while the end at the orifice would show a cooling as observed. Have we not precisely analogous phenomena in Joule's experiment? For a very small fraction of a second (perhaps .0001) after the stop-cock was opened, there would be a partial vacuum in *A*, into which the air streams; but after that the particles would not impinge upon the sides of *A*, but would have their velocity diminished and finally overcome by striking other particles. In imparting this velocity, the particles in *B* would be slightly chilled. The air, in streaming out of *B*, would be cooled by expansion after an instant, and would serve to cool the end of *A* near the orifice, as we have just seen; also the chilled particles in *B* would stream into *A*, and thus cool it still more. Whatever may be the action in these vessels, it is certain that the final heating in *A*, and cooling in *B*, would be exceedingly slight as shown by Joule's experiment, though it does not seem that the popular explanation is entirely correct.

It seems to me this question of the action of air in Joule's two vessels is an intensely interesting one. The conclusion that the chilling of the air in the vessel due to the work of imparting a velocity to its particles is very slight, corroborates in a marked manner the experiments tried by the present writer, in which he found a cooling of four degrees, while the dynamical cooling should have been ten times greater. The quotation from Ganot shows precisely an analogous case.

H. A. HAZEN.

Washington, Nov. 17.

### Children as Teachers.

FROM olden times it has been thought that adults should be the teachers, and children simply learners; but in this nineteenth century of civilization the greatest find that they can learn from the little ones. The best educators are those who have learned most from little children, and the most successful primary teachers are those who can see and feel things as children see and feel them. Authors of literature and text-books for children must now know child-nature, or fail. Scientific philologists are beginning to recognize the fact that children just learning to talk can in a few months teach them more about how languages are formed than can be learned by years of study of dead and living languages. Even the philosopher and psychologist are turning to the child for the solution of some of the problems that have so long baffled them, and the practical moralist turns from theories to learn of children how moral ideas are formed and moral action called forth.

The development of the race is epitomized in the development of the child, and the observer may read it in the unfolding psychical activity of the innocent child with more pleasure and profit than in the learned histories of civilization.

Tiederman, Darwin, Taine, Alcott, Romanes, and other learned men have studied their own children scientifically, and taken notes on their development, while Perez Kussmaul and others have made observations on a number of children. Humphreys, Holden, and Noble have collected and examined the vocabularies of several children two years old, in order to discover the general laws of speech. Emily Talbot has collected observations of mothers on young babes. The most thorough and accurate study has, however, been made by Preyer, who carefully observed and experimented upon his boy during the first three years of his life, noting down each day every thing calculated to throw light upon the capacity of children and the order of the development of their powers. Much light has been thrown on many subjects by these investigations, but a sufficient number of carefully verified facts has not yet been collected to enable us with certainty to distinguish characteristics common to all from individual peculiarities. It has been made evident that not only must there be persevering exactness in observing and recording the facts, but that many of them can be accurately observed and correctly interpreted only by one versed in physiology and psychology.

Considerable interest has been aroused and many plans proposed designed to increase scientific knowledge on the subject, to bring parents into new and pleasanter relations with each other, and to preserve records of interest and value to the family. Probably no more acceptable or more valuable present could be given a child who has just attained his majority than a little book containing a record of his life from babyhood. The data contained in such a record would make it possible for him to obey the maxim "Know thyself," and to guide his life by that knowledge, while the little incidents of childish life that give so much pleasure when remembered and related by the parents would be preserved and enjoyed by himself and his descendants. Parents who have engaged in such observations have not only learned to understand their children better, and been drawn into closer relations with them, but have also found the task most interesting and delightful.

It will probably be years before the observations of many scientists on children can be collected, but in the mean time a father, mother, or older sister of ordinary intelligence can, by exercising patience and care, observe and record certain facts of child-development that will be as important and reliable as those furnished by the most learned scientist. These observations, also, are those made at the most interesting age of the child's life,—the period of the development of speech. With a little care, the mother can easily record the development of language in her cunning little prattler,—an evolution as remarkable and full of interest as that traced by the philologist in the languages of the various races in different ages, and throwing as much light on the origin of speech in man and the laws of its development. The mother who will make out a list of all the words now used by her little language-learner, and then carefully note down new words as they are learned, may contribute facts leading to results as important as have been discovered by scientists after years of investigation.

There are two principal things to notice in such a study: (1) the development of the power of articulating, and (2) the development of the intellect: hence it is necessary to keep two lists of words,—one containing all words articulated by the child, with indications as to how they are pronounced; and the other, all words used understandingly, those used only in direct imitation, only at sight of pictures in a book, or only from memory, as in nursery rhymes, being omitted from this list. The first list would indicate the common difficulties encountered in learning to articulate, and an examination of a sufficient number would make it possible to determine whether there really are any general laws of mispronunciation such as have been proposed. The second list would indicate the intellectnal progress of the child as it learns new words, and learns to use old ones with increasing accuracy, and to put them together into phrases and sentences. Words that are invented by the child, and those used in a sense different from the ordinary meaning, are especially interesting, and throw considerable light on the subject of how children classify and generalize. A child who saw and heard a duck on the water called it "quack;" and, this word being thus associated with the bird and with the liquid upon which it rested, he thereafter called all birds and all liquids "quack," and later, seeing the eagle on a coin, he called that and other coins "quack." The observing mother will note many similar peculiar yet natural uses of words by her little one who is getting acquainted with this complex world of ours and learning the strange language of its inhabitants.

After the child's present vocabulary has been obtained as accurately as possible, its further progress can easily be recorded by noting down new words as they are heard (in alphabetical order). It will be found convenient to use separate sheets for each week, or perhaps for each month in the case of the articulating vocabulary. No confusion will then result, and on the back of the sheets may be given the peculiar meanings attached to words, the earlier attempts at putting words together, the later sentences of interest, especially those showing the characteristic grammatical errors, and other items of interest. Such lists of words, kept from the time a child begins to talk until he is three years of age, could not fail to give interesting and more or less important results; and a comparison of a number of vocabularies of children under three years of age, such as could be obtained by a few months of observation, would have a similar value. How much do the vocabularies of children in cities differ from those in the country or in villages? What is the effect on the vocabulary of associating with other children of nearly the same age? What influence does ease or difficulty of pronunciation have upon the adoption of words into the vocabulary, and what is the effect of special teaching by parents? These are a few of the many interesting questions that might be answered from such vocabularies, accompanied by the necessary information. Notwithstanding these various influences, many of the same words would probably be found in all of the vocabularies. I found sixty-four words used in common by four little girls two years of age.

It is to be hoped that such observations by parents of children who are just learning to talk will soon become common. If those who have begun, or will begin, such observations, will send me the record for several months before the middle of next May (1891), I shall be pleased to compare them, and report the result to the readers of this paper. If any thing of scientific value is obtained, it will be published, and along with it the names of those by whose patient observation it has been obtained. Besides the facts suggested above, the age and sex of the child, and the nationality of the parents, should be sent with the record.

Those who intelligently and sympathetically study the intellectual and emotional development of the child from day to day will find it more interesting than any continued story, and will gain more knowledge of human nature than by reading the most vivid character delineations.

E. A. KIRKPATRICK.

Worcester, Mass., Nov. 25.

---

## BOOK-REVIEWS.

*Civilization: An Historical Review of its Elements.* By CHARLES MORRIS. 2 vols. Chicago, S. C. Griggs & Co. 12°. $4.

THIS work, as the author states, is not "a history of civilization in the ordinarily accepted sense of the term, but is offered rather as an outline view of its elements, with some attempt to set forth the philosophy of human progress." It opens with a general sketch of the earliest civilized nations, and then treats successively of the development of political institutions, religion and morals, industry, and the other leading elements in the progress of humanity. The author makes no pretence of original investigation into the facts, and seldom descends to details; and he presupposes in the reader a general knowledge of the world's history. He devotes but a small space to the periods before the dawn of historical literature, holding that our information about prehistoric ages is far too scanty to be of much use, and that "the conditions displayed by existing savages are no just example of primitive institutions." Thus the greater part of the book relates to the civilization that began in Egypt and Babylonia, and has since spread over Europe and America; but the partial development of civilization in China and India and in ancient Mexico and Peru is not neglected.

The merit of the work is not of the highest order, yet there is much in it that is good. Its principal defect is in the style, which is diffuse and almost garrulous, the author being apparently troubled with too great a development of the linguistic faculty. The division and arrangement of topics are also such as to cause a good deal of repetition; so that the exposition fills a larger space than is necessary. As for Mr. Morris's philosophy, we do not find in it any thing specially new or striking; but he has evidently studied the works of the best philosophic historians, and has thoroughly mastered all the prevailing theories, yet without making a hobby of any of them. He of course regards the history of civilization as a process of development; yet he makes but little reference to the special doctrines of the evolution school, and little use of their hackneyed phrases. The main defect in Mr. Morris's historical philosophy is his insufficient appreciation of the Greek civilization and of its rank among the various forms of human culture. He dwells on its defects rather than on its excellences; and the reader who got his information wholly from this book would be likely to think that Greece was no more important in the development of civilization than ancient India or modern Germany. Yet there is much in Mr. Morris's exposition that is valuable; and most of his views, we think, are sound, and likely to stand the test of time. On the whole, his work will take a respectable rank among American books, though we cannot say that it is up to the true standard of philosophic history.

## AMONG THE PUBLISHERS.

THE "Dictionary of Political Economy," which Mr. R. H. Inglis Palgrave, F.R.S., is editing, and which is to be published by Macmillan & Co., is now assuming a definite shape, and the first part is to be out in January. Among the contributors are Professor Ashley of Toronto, Professor Bastable of Dublin, Dr. Bauer of Vienna, Mr. Sydney Buxton, M.P., the Rev. A. Caldecott, Mr. Crump of the Record Office, M. A. Curtois *fils*, the Rev. Dr. W. Cunningham, Major Craigie of the Board of Agriculture, Professor Dunbar of Harvard, Professor Dewey of Boston, Professor F. Y. Edgeworth, Mr. Elliott, M. A. de Foville, Professor Foxwell, Dr. Robert Giffen, Mr. C. A. Harris, Dr. J. K. Ingram, Mr. J. N. Keynes, the Rev. T. J. Lawrence, Professor E. de Leveleye, Mr. R. Lodge, Professor F. W. Maitland, Professor J. E. C. Munro, Professor J. S. Nicholson, Mr. R. E. Prothero, the Rev. L. R. Phelps, Signor Pantaleoni, Mr. D. G. Ritchie, Professor Roberts-Austen, F.R.S, Professor H. Sidgwick, Professor Smith of Columbia, Professor Taussig of Harvard, and the Rev.

Publications received at Editor's Office, Nov. 10–22.

BINET, A. On Double Consciousness. Chicago, Open Court Publ. Co. 93 p. 12°. 50 cents.
BLANFORD, H. F. An Elementary Geography of India, Burma, and Ceylon. London and New York, Macmillan. 191 p. 16°. 70 cents.
BURGESS, W. Modern Fish Culture. Birmingham, Eng., Martin Billing, Son, & Co., Pr. 118 p. 12°. 25 cents.
CHURCH, W. C. The Life of John Ericsson. Vols. I. and II. New York, Scribner. 660 p. 8°. $6.
ENGLISH Literature, A Chart of, with References. Ed. by G. E. Maclean, Ph.D. Boston, Ginn. 13 p. 8°.
FAR and Near. Vol. I. No. 1. November, 1890. *m.* New York. The Critic Co. 16 p. 4°. $1 per year.
HOYT, D. L. Handbook of Historic Schools of Painting. Boston, Ginn. 210 p. 12°. $1.
LOCKYER, J. N. The Meteoritic Hypothesis. London and New York, Macmillan. 560 p. 8°. $5.25.
MORRIS, C. Civilization, an Historical Review of its Elements. Vols. I. and II. Chicago, Griggs. 1,000 p. 12°. $4.
MYERS, P. V. N. Ancient History for Colleges and High Schools. Part II. A History of Rome. Boston, Ginn. 123 p. 12°. $1.10.
PHYSICIAN'S Visiting List for 1891, The. Philadelphia, Blakiston. 16°.

P. H. Wicksteed. The object of the dictionary is to give a statement of the position of political economy at the present time, together with such references to history, law, and commerce, as may be of use. Articles on the main subjects usually dealt with in the works of economic writers will be found in it. Short notices of deceased economists, and of their chief contributions to economic literature, are also included. A list of works of leading living writers will be given at the end of the work. Bibliographical notes will likewise be added to the more important articles, with the titles and dates of publication of the principal books referred to.

— Macmillan & Co. have in press "A Dictionary of Classical Mythology, Religion, Literature, Art, and Antiquities," revised and edited from the German of Dr. Seyffert by H. Nettleship and J. E. Sandys. The work will contain nearly five hundred illustrations.

—In *Lippincott's Magazine* for December, 1890, "The Bermuda Islands" form the subject of an article by H. C. Walsh. These islands lie only about seven hundred miles from our eastern coast, and are rapidly growing in popularity as a winter resort, owing to the beauty of their scenery, their temperate climate, and the entire change of life which they afford. In "Types in Fiction," W. W. Crane takes up the cudgel against those authors "who select some particular locality or district, and take its inhabitants as specimens of a type." He objects to authors devoting their energies to portraying people not as individuals, but as samples of a certain type.

—C. W. Bardeen of Syracuse sends us "A Brief History of the Empire State," written by Welland Hendrick. It is a small quarto of two hundred pages, with many illustrations, and gives a very readable account of the history of New York and its people from the time of Henry Hudson to the present day. The author makes no pretence of original research, but has made good use of his authorities, and presents a considerable amount of matter in a small space. The style is simple yet manly, and distinctly superior to the style of some books written for young people. Mr. Hendrick has wisely confined himself to the affairs of the State, treating those of the Union only so far as to show the part that New York has played in them. We should think that the book would be useful both in the schools and in the families of the Empire State.

— In the *Atlantic* for December Mr. Birge Harrison gives an account of the new rival of the French salon, the National Society of Fine Arts, in a paper entitled "The New Departure in Parisian Art;" Mr. A. T. Mahan, in "The United States Looking Outward," shows the isolation of the country, not only in respect to position, but in regard to trade, and prophesies a change in public opinion, which will free us from our indifference to foreign nations, and open our eyes to the necessity of the defence of our own coasts, and a more active policy of trade with other countries; and there is an essay in the Contributors' Club, on "English and American Spelling," from one who, if his name were known, would be recognized as of highest authority.

—No. 47 of the Riverside Literature Series is a small collection of fables and folk-stories, by Horace E. Scudder. They are mostly selected from the author's previous volumes, the "Book of Fables" and "Book of Folk Stories," and are arranged with reference to the difficulty of reading them. The fables are mostly from Æsop, and are well presented. The folk-tales comprise "Little Red-Riding-Hood," "Puss-in-Boots," "Jack and the Bean-Stalk," and many others. The interest of fables, especially those of Æsop, is perennial, and they convey not a little prudential wisdom; but the fantastic and often stupid folk-stories cannot, it seems to us, have any attraction except for children. To them, however, the whole book will doubtless be interesting, and its simple yet refined style ought to make it a useful reading book.

CALENDAR OF SOCIETIES.

**Anthropological Society, Washington.**

Nov. 18.—Otis T. Mason, Natural History of the Arrow; William H. Holmes, The Arrow-Maker as a Mineralogist; DeLancey W. Gill, Arrow Flaking (illustrated); Walter Hugh, Arrow Pointing and Feathering (illustrated); Thomas Wilson, Forms of Ancient Arrow-Heads; Weston Flint, Arrows in Modern Archery; W. J. Hoffman, Arrow Poisons; J. G. Bourke, Myths of the Arrow.

**Philosophical Society, Washington.**

Nov. 22.—Charles F. Marvin, Wind Pressures and the Measurement of Wind-Velocities; William Hallock, The Co efficient of Expansion of Some Rocks.

**Natural Science Association of Staten Island.**

Nov. 8, Election of Officers. —President, Dr. N. L. Britton; treasurer, Eberhard Faber; recording secretary, Charles F. Simons; corresponding secretary, Arthur Hollick; curator, Jos. C. Thompson.

Dr. Britton alluded to his recent proposition (see *Bulletin Torrey Botanical Club*, vol. xvii. p. 121) to recognize plants which, with greater or less frequency, bear flowers of a color other than the normal hue under the rank of "forms," the difference not being sufficient to class them as varieties. Mr. Hollick exhibited specimens of lignite and pyrite from the recently opened fire-clay beds at Green Ridge. This clay has been mined in this locality to a depth of about thirty feet. It is covered by from six to ten feet of drift, and is undoubtedly of cretaceous age, the same as the Kreischerville clays, the two no doubt being continuous.



## *Wants.*

*Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head* FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

WANTED.—There being a considerable annual income for the purchase of books for the Museum Reference Library of Iowa College, it is desirable to have at hand any and all circulars, specimen sheets, catalogues, etc., of all works on Natural History in general, both foreign and domestic. Circulars of museum supplies, apparatus, etc., etc., desired also. State terms. Address ERWIN H. BARBOUR, Box 1333, Grinnell, Iowa.

WANTED.—A situation as Analytical Chemist is desired by the assistant of the late noted scientist, Dr. Cook, during his 15 years survey of the State of New Jersey. Highest testimonials furnished. Address Prof. EDWIN H. BOGARDUS, New Brunswick, P, O. Box 224, care Prof. F. C Van Dyck.

COULD some one inform me what the ingredients and origin of asphalt as used for street-paving and gathered at Trinidad are? Also how gathered and shipped by natives, and mode of refining by the Warren-Scharf Co. of New York and the Barber Co. of Washington? G. KNIPER, 28 Gunn Block, Grand Rapids, Mich.

WANTED.—A position in a Normal School or College as teacher of Botany, Physiology, Zoölogy, Embryology, Chemistry, Physics, or German, by a university graduate who has done special work in the above lines. Several years' experience in teaching, and one year as assistant in Biology in a prominent university. Box 396, Greencastle, Ind.

PROFESSOR W. M. DAVIS, Harvard College, Cambridge, Mass., desires to correspond with professional and amateur photographers, from whom he can obtain views of New England landscapes.

### Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 47 Lafayette Place, New York.]

I wish to exchange Eastern *Lepidoptera* for those that I do not have, particularly those found in the South. Jos. F. Crandall, Honesdale, Wayne Co., Pa.

To exchange, 1892 Seeger and Guernsey Cyclopedia, containing a complete list of the manufactures and products of the U. S., and address of first hands, cost $6. David R. Lewis, Saybrook, Ill.

For exchange—Nice specimens of Unios alatus, trigonus, parvus, occidens, anadontoides gibbosus, rectus, verucosus, gracilis coccineus, ventricasus, multiplicatus and plicatus cornutus. Margaritana confrogosa, complanata, rugosa. Anadonta edentula, decora, corpulenta, and about 300 of the beautiful Ana suborbiculata. Wanted: Unios from all parts of the world, and sea-shells. Address Dr. W. S. Strode, Bernadotte, Ill.



## SCIENCE CLUBBING RATES.

10% DISCOUNT.

We will allow the above discount to any subscriber to *Science* who will send us an order for periodicals exceeding $10, counting each at its full price.

| | Year's Subscription. | With Science. |
|---|---|---|
| Agricultural Science | $2.50 | $5.30 |
| American Agriculturist | 1.50 | 4.30 |
| American Architect and Building News | | |
| Imperial edition | 10.00 | 12.80 |
| Gelatine " | 7.00 | 9.80 |
| Regular " | 6.00 | 8.80 |
| American Garden | 1.00 | 4.25 |
| American Journal of Philology | 3.00 | 6.25 |
| American Machinist | 2.50 | 5.30 |
| American Naturalist | 4.00 | 7.50 |
| Andover Review | 4.00 | 6.80 |
| Atlantic | 4.00 | 6.80 |
| Babyhood | 1.50 | 4.30 |
| Bradstreet's | 5.00 | 7.80 |
| Brain | 3.50 | 6.30 |
| Building (weekly) | 6.00 | 8.80 |
| Carpentry and Building | 1.00 | 4.25 |
| Century Magazine | 4.00 | 6.80 |
| Chautauquan, The | 2.00 | 4.80 |
| Christian Union, The | 3.00 | 5.80 |
| Cosmopolitan, The | 2.00 | 4 80 |
| Critic | 3.00 | 5.80 |
| Eclectic Magazine | 5.00 | 7.80 |
| Edinburgh Review | 4.00 | 6.80 |
| Electric Age | 3.00 | 5.80 |
| Electrical World | 3.00 | 5.80 |
| Electrician and Electrical Engineer | 3.00 | 5.80 |
| Electrical Review | 3.00 | 5.80 |
| Engineering and Mining Journal | 4.00 | 6.80 |
| English Illustrated Magazine | 1.75 | 4.55 |
| Forest and Stream | 4.00 | 6.80 |
| Forum, The | 5.00 | 7.80 |
| Garden and Forest | 4.00 | 6.80 |
| Harper's Bazar | 4.00 | 6.80 |
| Harper's Magazine | 4.00 | 6.80 |
| Harper's Weekly | 4.00 | 6.80 |
| Harper's Young People | 2.00 | 4.80 |
| Illustrated London News (Amer. reprint) | 4.00 | 6.80 |
| Independent, The | 3.00 | 5.80 |
| Iron Age (weekly) | 4.50 | 7.30 |
| Journal of Microscopy and Natural Science (Eng.) | 1.75 | 4.55 |
| Judge | 4.00 | 6.80 |
| L'Art | 12.00 | 14.80 |
| Life | 5.00 | 7.80 |
| Lippincott's Magazine | 3.00 | 5.80 |
| Littell's Living Age | 8.00 | 10.80 |
| London Quarterly | 4.00 | 6.80 |
| Macmillan's Magazine | 3.00 | 5.80 |
| Magazine of American History | 5.00 | 7.80 |
| Medical and Surgical Journal | 5.00 | 7.80 |
| Mechanical Engineer | 2.00 | 4.80 |
| Metal Worker | 1.00 | 4.25 |
| Microscope, The | 1.00 | 4.25 |
| Nature | 6.00 | 8.80 |
| North American Review | 5.00 | 7.80 |
| Outing | 3.00 | 5.80 |
| Overland Monthly | 4.00 | 6.80 |
| Political Science Quarterly | 3.00 | 5.80 |
| Popular Science Monthly | 5.00 | 7.80 |
| Popular Science News | 1.00 | 4.25 |
| Portfolio, The | 7.50 | 10.30 |
| Practitioner | 3.50 | 6.30 |
| Public Opinion | 3.00 | 5.80 |
| Puck | 5.00 | 7.80 |
| Puck (German) | 5.00 | 7.80 |
| Quarterly Review (London) | 4.00 | 6.80 |
| Queries | 1.00 | 4.25 |
| St. Nicholas | 3.00 | 5.80 |
| Scientific American | 3.00 | 5.80 |
| Supplement | 5.00 | 7.80 |
| Architect and Builders' edition | 2.50 | 5.30 |
| Scribner's Magazine | 3.00 | 5.80 |
| Texas Siftings | 4.00 | 6.80 |
| Trained Nurse | 1.50 | 4.30 |